

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Fibre optic interconnecting devices and passive components – Basic test and measurement procedures –
Part 2-14: Tests – High optical power

Dispositifs d'interconnexion et composants passifs à fibres optiques –
Méthodes fondamentales d'essais et de mesures –
Partie 2-14: Essais – Puissance optique élevée



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**FIBRE OPTIC INTERCONNECTING DEVICES
AND PASSIVE COMPONENTS –
BASIC TEST AND MEASUREMENT PROCEDURES –****Part 2-14: Tests – High optical power**

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International Standard IEC 61300-2-14 has been prepared by subcommittee 86B: Fibre optic interconnecting devices and passive components, of IEC technical committee 86: Fibre optics.

This third edition cancels and replaces the second edition published in 2005 and constitutes a technical revision.

This edition includes the following significant technical change with respect to the previous edition:

- fundamental change of the measurement method to introduce various measurement environments such as limited testing resources.

The text of this standard is based on the following documents:

FDIS	Report on voting
86B/3488/FDIS	86B/3533/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 61300 series, published under the general title *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

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FIBRE OPTIC INTERCONNECTING DEVICES AND PASSIVE COMPONENTS – BASIC TEST AND MEASUREMENT PROCEDURES –

Part 2-14: Tests – High optical power

1 Scope

This part of IEC 61300 describes a procedure for determining the suitability of a fibre optic interconnecting device or a passive component to withstand the exposure to optical power that may occur during operation.

NOTE General information and guidance concerning relevant test and measurement procedures is contained in IEC 61300-1.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60825-1, *Safety of laser products – Part 1: Equipment classification and requirements*

IEC 61300-1, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 1: General and guidance*

IEC 61300-3-1, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-1: Examinations and measurements – Visual examination*

IEC 61300-3-3, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-3: Examinations and measurements – Active monitoring of changes in attenuation and return loss*

IEC 61300-3-35, *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-35: Examinations and measurements – Fibre optic connector endface visual and automated inspection*

3 Apparatus

3.1 Source (S)

The source unit consists of an optical emitter, the means to connect to it and the associated drive electronics. A tunable light source (TLS) in which a specific output wavelength can be tuned may be chosen as the optical emitter. A TLS may consist of a tunable LD and an optical amplifier, or be a fibre ring laser in order to get an efficient power to test. Generally, the power and stability requirements of a test will necessitate that the means to connect to the optical emitter be a fibre pigtail. It shall be stable in output power and wavelength/frequency over the measurement period. For DWDM devices, the frequency uncertainty (instead of the wavelength uncertainty) shall be less than half of the channel bandwidth. Unless otherwise stated in the relevant specification, the source shall have the following characteristics:

a) Centre wavelength uncertainty including stability:

- nominal centre wavelength ± 5 nm (for WWDM and CWDM devices);
- b) Centre frequency uncertainty:
 - nominal centre frequency $\pm 6,3$ GHz (for DWDM devices of 25 GHz channel bandwidth);
 - nominal centre frequency $\pm 12,5$ GHz (for DWDM devices of 50 GHz channel bandwidth);
 - nominal centre frequency ± 25 GHz (for DWDM devices of 100 GHz channel bandwidth).
- c) Output power uncertainty and stability:
 - nominal output power $\pm 0,05$ dB.

3.2 Optical detector (D)

The optical detector unit is an optical power meter and consists of an optical detector, the means to connect to it and the associated electronics. The detectors shall have sufficient dynamic range to make the necessary measurements and shall be linear over the measurement range. The detectors shall be stable over the measurement period and shall have an operational wavelength range consistent with the DUT. The connection to the detectors shall be an adaptor that accepts a connector plug of the appropriate design. The detectors shall be capable of capturing all light emitted by the connector plug. Unless otherwise stated in the relevant specification, the detectors shall have the following characteristics:

- linearity: $\leq \pm 0,1$ dB;
- uncertainty including polarization dependency: $\leq \pm 0,05$ dB;
- resolution: $\leq \pm 0,01$ dB.

3.3 Environmental chamber

The test set-up shall include an environmental chamber capable of producing and maintaining the specified temperature and/or humidity.

3.4 Data acquisition system (DAS)

Recording of the optical power readings at the optical detector may be done either manually or automatically. Appropriate DAS shall be used where measurements are performed automatically.

3.5 Branching device (BD)

The splitting ratio of the branching device shall be stable over the optical powers and wavelengths chosen for the test. It shall also be insensitive to polarization. The branching devices shall be stable during the test. The splitting ratio of 1:99 for branching devices is recommended in order to input high power to the DUT and low power to the optical detector.

3.6 Temporary joints (TJ)

These are typically used in connecting the device under test to the test apparatus. Generally, the optical power and stability requirements of a test will necessitate that the temporary joints be fusion splices.

3.7 Safety devices

All necessary safety devices, including laser safety glasses, signs and other safety materials, shall be provided in order to protect individuals from possible hazards during testing.

3.8 Test set-up

For two-port optical components, a typical layout for the test apparatus is shown in Figure 1.

This test procedure involves the use of optical powers, which constitute a potential ocular and skin hazard to test personnel. All necessary safety procedures shall be adopted in accordance with IEC 60825-1. In particular, the DUT shall be unpowered (that is, with no power propagating in the fibre) when conducting a visual examination.

Optical connectors shall not be used. Fusion splices shall be used for all connecting points as described in 3.6.

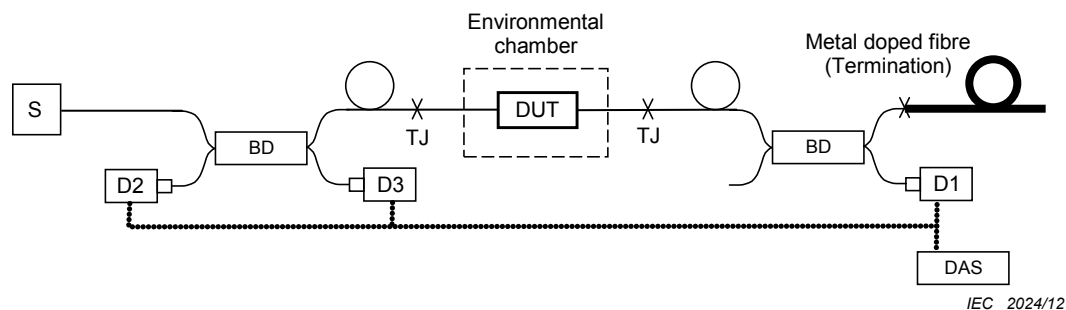


Figure 1 – Optical power test set-up

For multiport devices such as branching devices, all combinations of input and output ports shall be tested, unless otherwise stated in the relevant specification.

For WDM devices, multi-wavelength shall be input at the same time according to the application. Clause A.1 describes an example of the test set-up for WDM devices.

To minimize test equipments, the DUTs can be connected as a series. Clause A.2 describes an example of the test set-up for a series connection of DUTs.

4 Procedure

4.1 Preconditioning

The chosen test samples shall be representative of a standard product.

Prepare and clean the DUTs according to the manufacturer's instructions. Visual examination shall be undertaken in accordance with IEC 61300-3-1 and IEC 61300-3-35. Debris or the presence of contamination is one of the primary causes of failure in high optical power connector applications.

Precondition the DUTs for 2 h at the standard atmospheric conditions as defined in IEC 61300-1, unless otherwise specified in the relevant specification.

4.2 Initial examinations and measurements

Complete initial examinations and measurements on the DUTs as required by the relevant specification. The results of the initial measurement shall be within the limit established in the relevant specification.

4.3 Conditioning

4.3.1 Set the chamber and the DUT to the standard atmospheric conditions. Place the DUT in the chamber in its normal operating position. The hook-ups of the DUT to the peripheral equipment shall also be placed in its normal operating position, when required.

4.3.2 Adjust the chamber temperature and humidity to the specified severity. The rate of change of temperature shall not exceed 1 °C/min, averaged over a maximum period of 5 min. Allow the DUT to reach stable temperature and maintain the temperature for the exposure time.

4.3.3 Set the wavelength and optical power to be input to the DUT and turn on the optical source and input optical power to the DUT.

4.3.4 Continue to input the optical power to the DUT for the exposure time specified in severity. Monitor the changes in attenuation and return loss of the DUT according to IEC 61300-3-3 during the exposure time. The changes shall be within the pass criteria specified in the relevant specification (see Annex B).

4.3.5 At the completion of the exposure time, stop inputting the optical power and change the temperature in the chamber to the standard atmospheric condition. Continue to maintain the DUT in the chamber while the temperature is gradually changed.

4.4 Recovery

Allow the DUT to remain under the standard atmospheric condition for 2 h, as defined in IEC 61300-1, unless otherwise specified in the relevant specification.

4.5 Final examinations and measurements

On completion of the test, remove all fixtures and make final examinations and measurements on the DUT, as required by the relevant specification, to ensure that there is no permanent damage to the DUT. Clean the DUT according to the manufacturer's instructions. The results of the final measurement shall be within the limit established in the relevant specification.

Unless otherwise specified in the relevant specification, visually examine the DUT in accordance with IEC 61300-3-1. Check for evidence of any degradation in the DUT. This may include, for example:

- a) broken, loose or damaged parts or accessories;
- b) breaking or damage to the cable jacket, seals, strain relief or fibres;
- c) displaced, bent, or broken parts.

5 Severity

5.1 General

Severity is a combination of an optical power, a wavelength, a temperature, humidity and an exposure time. The severity shall be specified in the relevant specification.

5.2 Optical power

The optical power of the test shall be decided in consideration of the application, unless otherwise stated in the relevant specification. The following optical powers are examples:

- 10 mW, 30 mW, 50 mW, 100 mW, 300 mW and 500 mW.

5.3 Wavelengths

The test wavelength shall be the centre or typical wavelength of all operating wavelength ranges specified in the relevant specification. The following wavelengths are examples:

- 980 nm, 1 310 nm, 1 490 nm, 1 510 nm, 1 550 nm, 1 580 nm, 1 610 nm and 1 650 nm.

For WDM devices, the combinations of multi-wavelengths which are input at the same time, shall be decided in consideration of the application, unless otherwise stated in the relevant specification.

5.4 Temperature

Unless otherwise stated in the relevant specification, the test temperature shall be the maximum temperature of the operating temperature range specified in the relevant specification.

5.5 Humidity

Unless otherwise stated in the relevant specification, the test humidity shall be controlled at the maximum humidity of the operating humidity range specified in the relevant specification.

In case the DUT is hermetically seal-packaged, the test humidity does not need to be controlled.

5.6 Exposure time

The test exposure time shall be decided in consideration of the thermal capacity of the DUT. For a small component whose weight is approximately less than 0,1 kg, the test exposure time of 30 min is recommended.

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6 Details to be specified

The following details, as applicable, shall be specified in the relevant specification:

- a) optical power;
- b) wavelengths;
- c) temperature;
- d) humidity;
- e) exposure time;
- f) initial examinations, initial measurements and initial performance requirements;
- g) examinations during test, measurements during test and performance requirements during test;
- h) final examinations, final measurements and final performance requirements;
- i) deviations from test procedure;
- j) additional pass/fail criteria;
- k) number of ports and combinations of input and output ports;
- l) combinations of multi-wavelengths which are input at the same time for WDM devices.

Annex A (normative)

Examples of test set-up

A.1 WDM devices

For WDM devices, multi-wavelength shall be input at the same time according to the application. For two inputs/one output WDM components, a typical layout for the test apparatus is shown in Figure A.1.

The optical power of the first wavelength is input from the source S1. In addition, the optical power of the second wavelength is input from the source S2 at the same time. The optical power ratio of the first wavelength and second wavelength shall be stated in the relevant specification, based on the application. In Figure A.1, the attenuation changes for the first wavelength and second wavelength are monitored at the wavelength tunable optical detector D1, respectively. For the tunable optical detector D1, an OSA (Optical Spectrum Analyser), or a combination of a tunable filter and an optical power meter, is recommended.

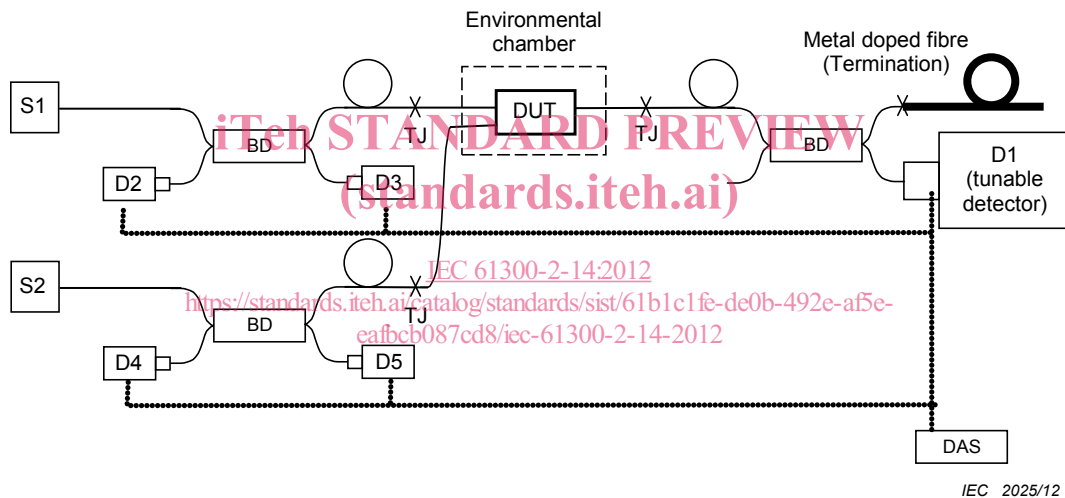


Figure A.1 – Optical power test set-up for WDM device

A.2 Series connection set-up

To minimize test equipments, the DUT can be connected as a series. To test three DUTs simultaneously, a typical layout for the test apparatus is shown in Figure A.2.

In this set-up, the optical power input to the last DUT, for example, DUT3 in Figure A.2, shall be equal or higher than the optical power specified in the relevant specification.